

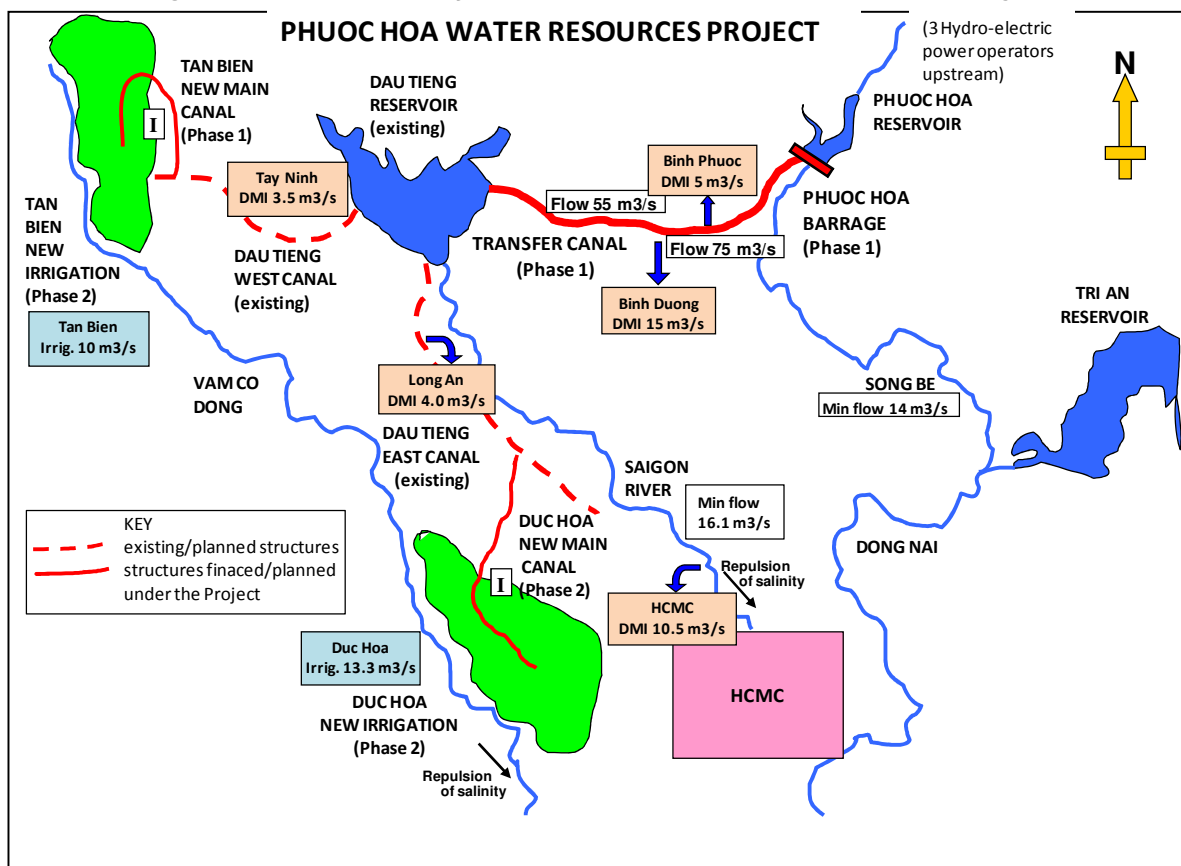
I. DETAILED ECONOMIC ANALYSIS

A. Introduction

1. The Phuoc Hoa Water Resources Development Project was conceived in the 1980s and is designed to transfer water from the Be River by a transfer canal to the Dau Tieng reservoir to provide water for irrigation and domestic, municipal and industrial (DMI) use and to supplement the flow in the Saigon River. The project is designed to provide water for DMI use in Ho Chi Minh City (HCMC) and surrounding provinces and irrigation water for an area of 20,545 ha in Tay Ninh and Long An provinces. The original project, with an estimated cost of \$164.6 million with funding from Asian Development Bank (ADB) and Agence Française de Développement (AFD), started in 2004 and was scheduled for completion in 2011, but due to cost increases there are not sufficient funds to complete the project and a supplementary loan is required to complete the scope of works. A schematic diagram of the project is shown in Figure 1.

2. This document presents the economic and financial analysis of the proposed supplementary loan. Increased and more reliable water supply from the project will produce benefits from irrigation, and DMI water use. For irrigation, the primary benefit is increased agricultural production, which is measured by the incremental value of increased production between the future without-project and future with-project situations. The supply of water for DMI use will also produce economic benefits as an alternative to other more expensive sources of supply, and as a factor in industrial production.

Figure 1: Schematic Layout of Phuoc Hoa Water Resources Project



3. Secondary benefits that cannot necessarily be fully quantified include (i) salinity abatement in the Saigon River basin; (ii) improved drainage associated with irrigation infrastructure; and (iii) other multiple use and domestic use benefits such as the recreational use of reservoirs, improved water supply for cleaning and drinking in rural households and watering home gardens, and positive impacts on health and livelihood.

B. Methodology and Key Assumptions

4. The economic analysis follows a conventional cost–benefit analysis of calculating with-project costs and benefits minus without-project costs and benefits, with all costs and benefits converted to economic values and the results expressed as the economic internal rate of return (EIRR) and net present value, which can be compared with the opportunity cost of capital, assumed to be 12%. The economic analysis adheres to the following:

- (i) Costs and benefits are expressed in dong at 2010 constant prices using an exchange rate of D18,980 = \$1 (June 2010).
- (ii) Civil works and irrigation are assumed to have an economic life of 30 years, though the infrastructure can be expected to last much longer. The life of the project is restricted to 30 years.
- (iii) Economic costs of capital construction and maintenance costs are based on financial cost estimates adjusted to allow for transfer payments, taxes, and duties and to correct market distortions.
- (iv) The shadow value of labor is 0.8, in recognition of the low marginal productivity of unskilled labor in agriculture, construction, and maintenance.
- (v) Separate economic analyses are presented for three scenarios: phase 1 only, phases 1 and 2 combined, and phase 2 only. Separate analyses were also prepared for the Tan Bien and Duc Hoa subprojects.

5. Without supplementary financing, the project is assumed to stop with phase 1 and the completion of the barrage headworks, transfer canal, and Tan Bien main canal. The development of the two irrigation systems would not be completed, so the full benefits of irrigation development and industrial water supply would not eventuate. The economic performance of phase 1 can be compared with the economic return for phases 1 and 2 combined. Another case is supplementary financing being provided and the scope of works completed. The economic assessment of phase 2 alone with supplementary financing includes only the investment costs associated with phase 2, excluding the sunk costs incurred in phase 1, which are assessed against the benefits generated by the two irrigation systems disregarding DMI benefits already produced by the incomplete phase 1 of the project. Adopting a sunk cost approach means that the expected benefits from the original project are assessed against the reduced investment cost to complete the project. This means that the economic return from the supplementary financing can be expected to be significantly higher than the economic return from the original feasibility study including all its investment costs.

C. Benefits

1. Agricultural Benefits

6. The project involves the development of improved irrigation infrastructure a total of 20,545 ha in two subproject areas: Tan Bien and Duc Hoa each served by their own main canal. The potential irrigable command area has been assessed as 6,725 ha for the Tan Bien

subproject, made up of 5,230 ha served by gravity and 1,495 ha served by a pump station with a 9 km long delivery canal. (consequently the pump area has a much higher cost per ha than the gravity area). Provision is made for an area of 230 ha for aquaculture in the gravity irrigation area. The irrigable area for Tan Bien has been reduced from earlier estimates because of the expansion of rubber plantations in this area which does not require irrigation.

7. The Duc Hoa subproject has an irrigable area of 13,821 ha, this area is also less than previous estimates, and is constrained by the amount of water to be delivered through the new Duc Hoa main canal. Areas designated for industrial use and land that will be bisected by major arterial motorways in the future has also been excluded from the potential command area. An area of around 2,000 ha in the northwest which used to be served by a pump station will be included in the scheme by reconfiguring its primary canal. An area of around 500 ha on the north of this canal will require water to be lifted out of the canal by farmer-owned pumps. Other pockets of high land within the scheme will also require some pumping. A reduction in the irrigable area in the future with-project situation of 2.5% is assumed to allow for land that is taken out of production for the construction of canals and structures.

8. Water from the Duc Hoa main canal will also provide an alternative and more reliable supply of irrigation to two other area that are not included in the development of irrigation PST systems. They are an area of 900 ha in HCMC province and 2,657 ha in Tay Ninh province. A reduced level of benefit from irrigation has been assumed for these area based on 30% of the average incremental benefit for Duc Hoa for the HCMC area, and 50% of the benefits of the Tan Bien scheme for the area in Tay Ninh province.

2. Cropping pattern

9. The cropping pattern in the current and without-project, and the future with-project situations is shown in the following table. This information is based on previous studies of the project, particularly the 2000 feasibility study and the 2008 mid-term review and current information provided by the primary, secondary and tertiary (PST) system design consultants. Overall the cropping percentage for the three annual cropping seasons is assessed as 250% for Tan Bien and 190% for Duc Hoa. The winter-spring cropping season which coincides with the main dry season has the lowest cropping percentage currently as irrigation water is essential for cropping and land without water is left fallow during this time. Tan Bien has a much higher cropping percentage in the crucial winter-spring season on account of a slightly more reliable rainfall in that area and the reliance on cassava production in this area which has lower water demand. The summer-autumn season occurs during the main monsoon or rainy season when rice can be grown on rain fall alone. The majority of the land is cropped with rice during this season: this is the staple food crop, and the humid and often water logged field conditions are not conducive to growing peanuts and maize. During the following autumn-winter season many farmers are able to grow a second crop of rice, or take advantage of the dryer climatic conditions to grow peanuts, maize and vegetables.

Table 1: Cropping Patterns: Present and Future with-project
(Percent cover and hectares per subproject)

	Tan Bien (Gravity area)					Tan Bien (Pump area)					Duc Hoa			
	present	future	present	future		present	future	present	future		present	future	present	future
	%	%	ha	ha		%	%	ha	ha		%	%	ha	ha
Net cultivable area			5,364	5,230				1,533	1,495				14,175	13,821
				2.5%					2.5%					2.5%
Winter-spring														
Rice	10%	25%	536	1,307		0%	0%	0	0		5%	32%	658	4,353
Maize	0%	15%	0	784		10%	30%	153	448		20%	30%	2,892	4,105
Peanuts	3%	15%	161	784		3%	25%	46	374		14%	24%	1,967	3,358
Cassava	55%	15%	2,950	784		55%	15%	843	224		0%	0%	0	0
Vegetables	2%	4%	107	209		2%	4%	31	60		2%	4%	250	484
Sugarcane	5%	5%	268	261		5%	5%	77	75		0%	0%	0	0
Fruit trees	5%	8%	268	418		5%	8%	77	120		1%	2%	100	304
Subtotal	80%	87%	4,291	4,550		80%	87%	1,226	1,300		41%	91%	5,867	12,604
Summer-autumn														
Rice	40%	75%	2,146	3,922		40%	75%	613	1,121		82%	90%	11,624	12,439
Maize	0%	0%	0	0		0%	0%	0	0		0%	0%	0	0
Peanuts	3%	3%	161	157		3%	3%	46	45		0%	0%	0	0
Cassava	35%	0%	1,877	0		35%	0%	537	0		0%	0%	0	0
Vegetables	2%	4%	107	209		2%	4%	31	60		2%	3%	284	415
Sugarcane	5%	5%	268	261		5%	5%	77	75		0%	0%	0	0
Fruit trees	5%	8%	268	418		5%	8%	77	120		1%	2%	100	304
Subtotal	90%	95%	4,828	4,968		90%	95%	1,380	1,420		85%	95%	12,007	13,157
Autumn-winter														
Rice	10%	25%	536	1,307		10%	25%	153	374		40%	45%	5,670	6,219
Maize	0%	15%	0	784		0%	15%	0	224		10%	20%	1,418	2,764
Peanuts	3%	17%	161	889		3%	15%	46	224		11%	20%	1,559	2,764
Cassava	55%	15%	2,950	784		55%	15%	843	224		0%	0%	0	0
Vegetables	2%	4%	107	209		2%	4%	31	60		2%	4%	284	553
Sugarcane	5%	5%	268	261		5%	5%	77	75		0%	0%	0	0
Fruit trees	5%	8%	268	418		5%	8%	77	120		1%	2%	100	304
Subtotal	80%	89%	4,291	4,655		80%	87%	1,226	1,300		64%	91%	9,030	12,604
Total	250%	271%	13,410	14,173		250%	269%	3,833	4,021		190%	278%	26,904	38,366

10. In the future with-project situation the cropping percentage is assumed to increase to 271% for Tan Bien and 278% for Duc Hoa. Rice is expected to continue to be the major crop, but an increased area of the more financially profitable peanuts, maize, vegetable and fruits are expected, with a reduction in the less profitable sugar cane and cassava production. A maximum percentage of 95% of the land cropped in the summer-autumn season allows for the certain amount of land that is not cropped because of family circumstances and other factors.

3. Crop budgets

11. Crop budgets were prepared for the main agricultural crops cultivated in the two scheme areas (rice, maize, peanuts, cassava, sugar cane, vegetables and fruits) based on the input and out parameters applicable for the area.

12. Crop budgets are presented in financial prices using current financial prices, and in economic prices using border-parity prices for the main traded crops and crop inputs based on the latest World Bank international commodity price projections of June 2010.

Table 2: Agricultural Input and Output Prices
(In constant 2010 economic and financial prices, VND/unit)

		Unit	Financial 2010	Economic 2015-2020
Agricultural outputs				
Crop	Rice (paddy)	kg	5,500	4,045
	Maize (grain)	kg	4,200	3,580
	Cassava (fresh)	kg	750	750
	Peanut (unshelled)	kg	15,500	7,868
	Sugarcane (cane)	kg	600	600
	Vegetables	kg	3,500	3,500
	Fruits	kg	6,000	6,000
Agricultural inputs				
Seeds	Rice	kg	6,600	4,854
	Maize	kg	40,000	40,000
	Cassava	cutting	40	40
	Peanut	kg	22,000	22,000
	Sugarcane	cutting	240	240
	Vegetables	kg	43,000	43,000
Fertilizers	Urea	kg	6,000	4,947
	DAP	kg	9,600	6,396
	NPK	kg	8,000	5,437
	Superphosphate	kg	4,000	6,605
	KCl	kg	6,000	5,285
	Lime	kg	540	540
	Farm yard manure	ton	150,000	150,000
	Rice husk ash	ton	150,000	150,000
Agrochemicals	All types	lumpsum	1,000,000	1,000,000
	Ploughing & land preparation	ha	500,000	500,000
Equipment, materials etc	Rotavating	ha	500,000	500,000
	Discing	ha	500,000	500,000
	Ridging	ha	600,000	600,000
	Harvesting/threshing	tonne	300,000	300,000
	Transportation to farm gate	tonne	36,000	36,000
	Bags & packing material	tonne	33,000	33,000
	Tools & equipment	ha	55,500	55,500
Labour	Male/female	workday	75,000	60,000
Pumping	Gasoline/electricity	lumpsum	2,400	2,400
	Transportation to factory gate	tonne	36,000	36,000

Source: Field data. World Bank price projections.

13. For products not freely traded internationally, such as fruit and vegetables, the current domestic price has been used. Generally local financial prices are higher than the economic border parity prices based on the World Bank projections. Peanuts in particular have a much higher local price than the international equivalent, which is thought to be a reflection of their high demand for confectionary and snack food in HCMC.

i. Crop yields

14. Crop yields for the present and future with-project situations are shown in the following table. Crop yields are assumed to increase by between 10% and 30% following the development of reliable irrigation, as a result of more reliable water supply, higher level of crop inputs and crop husbandry as the marginal returns to the factors of production are increased. The yields of peanuts and maize are not projected to increase as much as rice as these crops are usually grown in the dry season with irrigation at present.

Table 3: Crop Yields
(Tonne per hectare)

	Tan Bien		Duc Hoa	
	Present	Future With	Present	Future With
Winter-spring				
- Rice(paddy)	4.20	5.50	3.75	5.00
- Maize (grain)	5.00	6.00	5.00	6.00
- Peanuts (unshelled)	2.00	2.50	2.00	2.50
- Vegetables	15.50	17.00	15.50	17.00
Summer-autumn				
- Rice	4.80	5.50	4.00	5.50
- Maize	na	na	4.00	5.00
- Peanuts	2.00	2.50	1.80	2.20
- Vegetables	15.50	17.00	15.50	17.00
Autumn-winter				
- Rice	4.20	5.50	3.75	5.00
- Maize	5.00	6.00	5.00	6.00
- Peanuts	2.00	2.50	2.00	2.50
- Vegetables	15.50	17.00	15.50	17.00
Multi-season crops				
- Sugar cane	60.00	75.00	60.00	75.00
- Cassava	35.00	43.75	na	na
- Fruit	15.00	20.00	15.00	20.00

Source: Consultants estimates

15. A summary of the crop budgets in financial and economic prices is shown in the table below. Vegetables and fruit have the highest gross margin in both financial and economic terms. Peanuts have a much lower return in economic terms than in financial terms on account of the higher domestic price. Rice has a consistently high return for all seasons, which reinforces farmers' preference to grow rice and the dominance of rice in the cropping patterns. Cassava and sugar cane, although longer term crops also show a reasonable return.

Table 4: Summary of Crop Budgets
(In constant 2010 financial and economic prices, VND'000/ha/crop season)

Crops	Financial				Economic			
	Tan Bien		Duc Hoa		Tan Bien		Duc Hoa	
	wop	wp	wop	wp	wop	wp	wop	wp
Winter-spring								
Rice	9,551	18,833	4,974	14,001	3,679	11,020	1,487	8,644
Maize	7,886	9,409	3,444	9,639	6,640	8,893	3,342	9,123
Peanuts	8,439	17,967	8,439	17,967	-5,106	-3,479	-5,106	679
Cassava (9 month)	11,822	17,149	na	na	13,923	19,430	na	na
Vegetables	22,074	30,095	22,074	30,095	25,443	33,464	25,443	33,464
Sugarcane	na	na	na	na	na	na	na	na
Summer-autumn								
Rice	13,818	18,833	6,252	16,557	7,074	11,020	2,402	10,473
Maize	na	na	na	na	na	na	na	na
Peanuts	9,399	17,967	5,833	13,339	-4,146	-3,479	-6,185	-1,660
Cassava (6 month)	11,822	17,149	na	na	13,923	19,430	na	na
Vegetables	22,074	30,095	22,074	30,095	25,443	33,464	25,443	33,464
Sugarcane	na	na	na	na	na	na	na	na
Autumn-winter								
Rice	9,551	18,833	4,974	14,001	3,679	11,020	1,487	8,644
Maize	7,886	9,409	3,444	9,639	6,640	8,893	3,342	9,123
Peanuts	8,439	17,967	8,439	17,967	-5,106	-3,479	-5,106	679
Cassava (9 month)	na	na	na	na	na	na	na	na
Vegetables	22,074	30,095	22,074	30,095	25,443	33,464	25,443	33,464
Sugarcane	10,743	17,011	10,743	17,011	12,258	18,959	12,258	18,959
Fruit trees 1/	65,219	86,459	65,219	86,459	69,318	91,867	69,318	69,318

Note 1/ Indicative returns from a combination of fruit production.

Source: Asian Development Bank estimates

ii. Incremental benefits

16. The crop gross margins are combined with the cropping pattern to generate the incremental benefits for each subproject. A summary of the incremental benefits is presented in the following table. At full development total agricultural benefits are estimated to be D88.7 billion (\$4.673 million) per year for Tan Bien and D303.541 billion (\$15.0 million) for Duc Hoa, a total of D392.2 billion (\$19.673 million) per year. The average incremental benefit in economic terms per ha for Tan Bien is D13.2 million (\$695) per ha at full development while for Duc Hoa the incremental benefit is considerably higher at D26.4 million (\$1,157) per ha. Duc Hoa currently has a lower cropping intensity in the future without situation resulting in a bigger change in cropping intensity with-project, and its closer proximity to the consumer markets in HCMC makes vegetable and fruit production more attractive.

17. The incremental benefits from irrigation are assumed to buildup over a period of 10 years after the completion of the main irrigation infrastructure.

Table 5: Agricultural Incremental Benefits
(VND million/scheme/year in constant 2010 economic prices)

	Tan Bien (gravity)			Tan Bien (pump)			Duc Hoa		
	present	future	increment	present	future	increment	present	future	increment
Winter-spring									
Rice	1,974	14,408	12,434	0	0	0	978	37,634	36,655
Maize	0	6,976	6,976	1,018	3,987	2,970	9,664	37,446	27,782
Peanuts	-822	-2,730	-1,908	-235	-1,300	-1,065	-10,043	2,279	12,322
Cassava (9 mth)	41,075	15,243	-25,833	11,739	4,356	-7,383	0	0	0
Vegetables	2,730	7,001	4,271	780	2,001	1,221	6,361	16,187	9,827
Sugarcane	-	-	0	-	-	0	-	-	0
Fruit trees	-	-	0	-	-	0	-	-	0
Subtotal	44,957	40,898	-4,059	13,302	9,044	-4,258	6,960	93,546	86,586
Summer-autumn									
Rice	15,178	43,224	28,046	4,338	12,353	8,015	27,914	130,273	102,359
Maize	0	0	0	0	0	0	0	0	0
Peanuts	-667	-546	121	-191	-156	35	0	0	0
Cassava (6 mth)	0	0	0	0	0	0	0	0	0
Vegetables	2,730	7,001	4,271	780	2,001	1,221	7,213	13,875	6,662
Sugarcane	-	-	0	-	-	0	-	-	0
Fruit trees	-	-	0	-	-	0	-	-	0
Subtotal	17,240	49,678	32,438	4,927	14,198	9,271	35,127	144,148	109,021
Autumn-winter									
Rice	1,974	14,408	12,434	564	4,118	3,554	8,432	53,762	45,331
Maize	0	6,976	6,976	0	1,994	1,994	4,737	25,216	20,480
Peanuts	-822	-3,093	-2,272	-235	-780	-545	-7,961	1,876	9,837
Cassava (9 mth)	0	0	0	0	0	0	0	0	0
Vegetables	2,730	7,001	4,271	780	2,001	1,221	7,213	18,500	11,287
Sugarcane	3,288	4,958	1,670	940	1,417	477	0	0	0
Fruit trees	18,591	38,436	19,845	5,313	10,985	5,672	6,932	27,932	21,001
Subtotal	25,760	68,685	42,925	7,362	19,734	12,372	19,352	127,287	107,934
Total	87,957	159,261	71,303	25,592	42,976	17,384	61,440	364,981	303,541

Source: Asian Development Bank estimates

D. DMI Water Use

18. The Phuoc Hoa water resource project is planned to provide a total supply of 38m³/sec of raw water for domestic, municipal and industrial (DMI) use divided as follows:

Table 6: DMI Water Supply

Province	m³/s
Binh Phuoc	5.0
Binh Duong	15.0
HCMC	10.5
Tan Bien	3.5
Duc Hoa	4.0
Total	38.0

19. The value of the DMI supply is included as an economic benefit with a buildup in demand assumed to occur over a period of 15 years from 2011 as the necessary infrastructure and industrial capacity is developed to fully utilize the supply for DMI water.

E. Costs

20. All costs were compiled in the COSTAB costing software program based on historical costs of expenditure to date for phase 1 provided by Hydraulic Project Investment and Construction Management Board No.9 (ICMB9) and ADB records, with estimates of the future costs for completing the works in phase 2. Phase 2 civil works costs were based on the estimates prepared by the PST Design consultants for Tan Bien and Duc Hoa schemes contracted to the provincial project management boards (PPMBs). Other component costs for project management, consultants, On-Farm and Social Development Program (OSDP), resettlement and environmental management were estimated by the consultants based on discussion with the PPMBs and ICMB9 and other stakeholders.

21. A physical contingency allowance of 10% was applied to all future costs and price contingency based on the ADB's projected cost escalation and inflation rates for Vietnam and international costs was applied at the following rates:

Table 7: Inflation Rates

Category	2011	2012	2013	2014	2015
Local cost	8%	6%	6%	6%	6%
Foreign cost	1.5%	0.7%	0.0%	0.5%	0.5%

1. Phase 1 Costs

22. The cost of completing all works associated with phase 1 (which consists of the construction of the headworks/barrage, transfer canal and Tan Bien main canal) is estimated to be \$174.6 million (D3,118 billion) allowing for expenditure incurred to date and the completion of approved contracts and estimated pending contract variations to complete the work by mid 2011. Part B water resources infrastructure is estimated to make up 64% of the base costs. Price contingencies are calculated by COSTAB to be negative because of the devaluation of the Dong against the US Dollar over the life of the project. A summary is provided in the table below.

Table 8: Total Phase 1 Project Costs

	Local	Foreign	Total	% Foreign Exchange	% Total Base Costs
A. Part A: Support for Institutional and Integrated Development					
1. Project and Sustainable Management					
a. Management Services	2.8	-	2.8	-	1.0
b. Consultants	5.0	5.5	10.5	52.0	5.0
Subtotal Project and Sustainable Management	7.8	5.5	13.4	41.0	7.0
2. Support for On-farm and Social Development	1.3	-	1.3	-	1.0
3. Resettlement	54.7	-	54.7	-	28.0
4. Environmental Management	1.3	0.0	1.4	2.0	1.0
Subtotal Part A: Support for Institutional and Integrated Development	65.2	5.6	70.8	8.0	36.0
B. Part B: Water Resources Infrastructure					
1. Phuoc Hoa Basin Transfer					
Barrage	53.0	-	53.0	-	27.0
Transfer Canal	60.3	-	60.3	-	31.0
UXO Clearance	0.9	-	0.9	-	-
Subtotal Phuoc Hoa Basin Transfer	114.2	-	114.2	-	58.0
3. Tan Bien Irrigation System					
Main Canals	11.0	-	11.0	-	6.0
Subtotal Part B: Water Resources Infrastructure	125.2	-	125.2	-	64.0
Total BASELINE COSTS	190.4	5.6	196.0	3.0	100.0
Physical Contingencies	0.0	0.0	0.0	20.0	-
Price Contingencies	- 21.4	0.0	- 21.4	-	11.0
Total PROJECT COSTS	169.0	5.6	174.6	3.0	89.0

Source: Asian Development Bank estimates based on ICMB9 data

2. Phase 2 Costs

23. The cost of phase 2 which involves completing the construction of the Tan Bien irrigation system and the construction of the Duc Hoa scheme with its main canal and irrigation system is estimated to be \$154.9 million (D2,940 billion) in total. However, it is estimated that there will be a carry-over of ADB loan funds from phase 1 of around \$23.3 m, so the actual amount that is subject to supplementary financing is reduced to \$131.4 million (D2,494 billion). Resettlement costs are estimated to contribute 33.4% to the base costs and overall Part B water resources infrastructure makes up 59.3% of base costs. A summary of the costs for all of the phase 2 expenditure is shown in the following table.

Table 9: Phase 2 Project Costs

	(D Million)	(\$ Million)	% Foreign Exchange	% Total Base Costs
	Total	Total		
A. Part A: Support for Institutional and Integrated Development				
1. Project and Sustainable Management				
a. Management Services	39,636.1	2.09	18	2
b. Consultants	90,098.3	4.75	61	4
Subtotal Project and Sustainable Management	129,734.4	6.84	48	5
2. Support for On-farm and Social Development	36,325.1	1.91	10	1
3. Resettlement	815,628.7	42.97	-	33
4. Environmental Management	12,872.6	0.68	20	1
Subtotal Part A: Support for Institutional and Integrated Development	994,560.9	52.40	7	41
B. Part B: Water Resources Infrastructure				
3. Tan Bien Irrigation System				
Primary/Secondary/Tertiary Canals	284,274.4	14.98	19	12
On-farm & Lower Canals	20,766.8	1.09	2	1
UXO Clearance	2,306.8	0.12	10	-
Subtotal Tan Bien Irrigation System	307,348.0	16.19	18	13
4. Duc Hoa Irrigation System				
Main Canals	434,442.1	22.89	30	18
Primary/Secondary/Tertiary Canals	672,540.2	35.43	20	28
On-farm & Lower Canals	35,444.1	1.87	2	1
Subtotal Duc Hoa Irrigation System	1,142,426.3	60.19	23	47
Subtotal Part B: Water Resources Infrastructure	1,449,774.4	76.38	22	59
Total BASELINE COSTS	2,444,335.2	128.78	16	100
Physical Contingencies	244,433.5	12.88	16	10
Price Contingencies	214,094.2	11.28	4	9
Total PROJECT COSTS	2,902,862.9	152.94	15	119
Interest During Implementation	37,794.7	1.99	100	2
Total Costs to be Financed	2,940,657.6	154.93	16	120

Source: Asian Development Bank estimates based on ICMB9 data

3. Phase 1 and 2 Costs Combined

24. The total overall cost of phase 1 and phase 2 combined is estimated to be \$329.5 million (D6,059 billion) over the nine year period from 2007 to 2015 which achieves the construction of the entire planned infrastructure and the development of 20,545 ha of irrigation in the Tan Bien and Duc Hoa schemes. This combines the historical costs already incurred and projected costs of completing the project. A summary of the costs for all of the total project expenditure is shown in the following table. Overall Part A: Support for institutional and integrated development makes up \$123.1 m, or 37.9% of base costs, with resettlement costs contributing the biggest amount at \$97.7 m. Civil works costs in Part B: Water resources infrastructure makes up \$201.6 m, or 62.1% of base costs. Expenditure on consultants makes up 4.7% of base costs and support of other soft expenditure categories including OSDP and environmental monitoring and management contributes only 5.2% to base costs.

Table 10: Phase 1 and Phase 2 Project Costs

	(D Million)	(\$ Million)	% Total Base Costs
	Total	Total	
A. Part A: Support for Institutional and Integrated Development			
1. Project and Sustainable Management			
a. Management Services	84,404.1	4.9	1.5
b. Consultants	257,107.4	15.3	4.7
Subtotal Project and Sustainable Management	341,511.5	20.2	6.2
2. Support for On-farm and Social Development	57,228.9	3.2	1.0
3. Resettlement	1,682,938.7	97.7	30.1
4. Environmental Management	34,730.7	2.0	0.6
Subtotal Part A: Support for Institutional and Integrated Development	2,116,409.8	123.1	37.9
B. Part B: Water Resources Infrastructure			
1. Phuoc Hoa Basin Transfer			
Barrage	839,633.0	53.0	16.3
Transfer Canal	955,902.3	60.3	18.6
UXO Clearance	14,190.0	0.9	0.3
Subtotal Phuoc Hoa Basin Transfer	1,809,725.3	114.2	35.2
3. Tan Bien Irrigation System			
Main Canals	174,682.0	11.0	3.4
Primary/Secondary/Tertiary Canals	284,274.4	15.0	4.6
On-farm & Lower Canals	20,766.8	1.1	0.3
UXO Clearance	2,306.8	0.1	0.0
Subtotal Tan Bien Irrigation System	482,030.0	27.2	8.4
4. Duc Hoa Irrigation System			
Main Canals	434,442.1	22.9	7.0
Primary/Secondary/Tertiary Canals	672,540.2	35.4	10.9
On-farm & Lower Canals	35,444.1	1.9	0.6
Subtotal Duc Hoa Irrigation System	1,142,426.3	60.2	18.5
Subtotal Part B: Water Resources Infrastructure	3,434,181.6	201.6	62.1
Total BASELINE COSTS	5,550,591.4	324.7	100.0
Physical Contingencies	244,705.8	12.9	4.0
Price Contingencies	226,099.4	-10.1	-3.1
Total PROJECT COSTS	6,021,396.7	327.5	100.8
Interest During Implementation	37,794.7	2.0	0.6
Total Costs to be Financed	6,059,191.4	329.5	101.5

Source: Asian Development Bank estimates based on ICMB9 data

F. Economic Prices

1. Conversion Factors

25. For the economic analysis the project costs as presented in the tables above are converted to their economic value by the removal of taxes, transfer payments and the shadow value of unskilled labor. The following conversion factors were applied in COSTAB to convert costs to their economic values.

Table 11: Economic Conversion Factors

Item	Conversion factor
Civil works	0.90
Design and overheads	0.93
On-farm irrigation system	
Structures	0.85
Canals	0.80
Environmental management	0.93
Project management	0.93
OSDP	0.93
Consultants	1.00
Resettlement	
Compensation	0.00
Implementation	0.93
Income support	0.93

Source: Asian Development Bank estimates

2. Operation and Maintenance Costs

26. The O&M costs for the water transfer and irrigation infrastructure is based on 1.5% of the original capital cost per year over the life of the project. At full development in economic prices terms this is equal to D52,737 million per year (\$2.78 million).

3. Pumping Costs

27. The cost of pumping for the Tan Bien pumped irrigation is calculated to be \$22.50 per ha per year based on a pumping head of 8 meters and a long run economic cost of electricity of US\$0.08 per kilowatt-hour.

4. Value of DMI Water Use

28. The value of DMI water is calculated as its opportunity cost for its use forgone in agriculture by calculating the average return to water for irrigation in the project area. Alternative methods were considered such as the least cost methods of developing alternatives supplies, or the marginal productivity of use in industrial production. However, insufficient information was available to support these methods. The simplest approach is to value DMI water at its opportunity cost for its use forgone in agriculture by calculating the average return to water for irrigation in the project area. Another approach is investigate the least cost options for developing alternative sources of supply for comparison with the cost of water from the Dau Tieng reservoir developed by the project. A more complete valuation of the water for industrial use is to value it as a factor of production similar to labor, land and capital. Various international studies have shown that water as a factor of industrial production for some sectors has a much higher return than its alternative use in agriculture. However for the project area reliable projections of the future supply and demand and use of DMI water are not available and for the full picture the environmental impact of increased industrial water use must take into account the downstream impact on pollution and cost of environmental control and waste water treatment. Water supply for DMI use will also require addition investment in conveyance and treatment that needs to be taken account of is estimated its economic value.

29. An analysis of the crop water demand and the incremental economic return to water in the Tan Bien and Duc Hoa irrigation area indicates an average return to water in the Winter/Spring cropping season of D1,168/m³, and higher return to incremental water use for the other cropping seasons when water supply is not so critical for crop production. The feasibility study of the Phuoc Hoa project prepared in 2008 assumed a value for DMI water of D502/m³ and the Black and Veatch International (BVI) 2000 feasibility study of the larger project a value of D300/m³ based on an analysis of the crop budgets at that time. For the purpose of this study the value of DMI water is taken as D750/m³, based on its opportunity cost for its use forgone in agriculture.

G. Results of Economic Evaluation

30. The cashflows in economic values for the three scenarios and the two irrigation schemes over the 30 year project life are available.

1. Phase 1

31. The economic analysis of phase 1, with estimated costs of \$174.6 million and benefits restricted to 34m³/second of DMI water, (Duc Hoa DMI excluded), resulted in an EIRR of 10.8%.

2. Phase 1 & 2 combined

32. The results for the economic analysis for the total project (phase 1 and 2 combined) implemented from 2007 to 2015 with costs estimated to be \$329.5 million, and including benefits from 20,545 ha of irrigation in the Duc Hoa and Tan Bien irrigation systems plus benefits from supplying supplementary irrigation water to a further 3,557 ha directly from the Duc Hoa main canal, resulted in an EIRR of 12.3%. DMI benefits arise from the 38m³/second distributed by the project in the four provinces and HCMC.

3. Phase 2 alone

33. The economic return for the phase 2 project funded by supplementary loans to complete the Tan Bien and Duc Hoa irrigation systems with all investment in phase 1 considered a "sunk cost", and with agricultural benefits from the two irrigation areas, supplementary irrigation and 7.5m³/second of DMI water is calculated to generate an EIRR of 16.9%.

4. Tan Bien and Duc Hoa schemes

34. The results of the economic analysis of the two irrigation schemes separately with their own direct phase 2 investment costs and the associated Part A costs apportioned between based on their relative scale shows an EIRR of 18.8% for Tan Bien and 16.4% for Duc Hoa. All costs associated with phase 1 are sunk costs. As the main canal for Tan Bien is constructed under phase 1 and a sunk cost the economic return for this scheme is higher. Duc Hoa despite having a relatively high capital investment cost per ha on account of expensive main canal and the siphon under still generates an acceptable EIRR. Duc Hoa has a relatively high level of incremental benefits.

35. The economic analysis shows that the continuing investment in phase 2 to complete the project is viable having a higher economic return than the option of stopping the project at the completion of phase 1. However the economic return is sensitive to the timing of realization of

the benefits with any delay in the completion of the infrastructure and completion of the PST and on-farm irrigation network significantly impacting the economic performance. Adequate maintenance of the completed infrastructure and ongoing support to the farmers in irrigation management and the functioning of participatory irrigation management are also important if the full potential of the investment is to be obtained.

H. Sensitivity analysis

36. The base case economic returns for the three scenarios and the two irrigation schemes were tested for changes in the main parameters affecting economic performance: capital costs, agricultural benefits, DMI benefits and timing of the agricultural benefits. The switching values (the percent change in a parameter required to achieve a 12% EIRR) are also calculated. The results are presented in the table below.

37. The overall project is most sensitive to a reduction in the level of agriculture benefits and increase in capital costs with a 2% reduction in agricultural benefits sufficient to reduce the EIRR to 12% for the overall project. A 5% increase in capital costs has the same affect. An increase in the recurrent O&M costs from 1.5% to 2.5 did not have such a significant effect on the EIRR. The phase 2 scenario is robust to significant changes in all the parameters on account of the sunk capital costs, and would require capital costs to increase by 47% to reduce the EIRR to less than 12%, or agricultural benefits to reduce by 21%. The two separate irrigation schemes Tan Bien and Duc Hoa have a robust economic return and would require a large increase in capital costs or reduction in agricultural benefits to reduce their EIRRs. A delay in the start of agricultural benefits of two years did not have as much affect as the other parameters while the value attributed to DMI water is important to the overall scheme analysis it is not important to the phase 2 only case and the two subprojects which would still achieve an EIRR of over 12% without any economic benefits from DMI water at all.

Table 12: Sensitivity Analysis & Switching Values**Sensitivity Analysis**

Scheme option	EIRR - Base Case and Sensitivity					
	Base Case	1 Capital costs increase by 20%	2 Ag benefits reduce by 20%	3 Delay in Ag benefits 2 years	4 Recurrent costs increased to 2.5%	5 DMI value reduced 20%
	%	%	%	%	%	%
Full Scheme						
Phase 1 & 2	12.3%	11.0%	8.7%	11.6%	11.8%	11.1%
Phase 1 only	10.8%	9.7%	na	na	10.4%	9.1
Phase 2 only	16.9%	14.6%	12.5%	14.7%	16.4%	16.2
Tan Bien scheme	18.8%	16.5%	14.3%	16.6%	18.4%	17.9
Duc Hoa scheme	16.4%	14.1%	12.0%	14.1%	15.8%	15.8

Switching Value

Scheme option	Switching Value (percent change to achieve 12% EIRR)			
	Base Case	1 Capital costs % change	2 Ag benefits % change	3 DMI value D/m3
	%	%	%	D/m3
Full Scheme				
Phase 1 & 2	12.3%	5.0%	-2.0%	710
Phase 1 only	10.8%	-15.0%	na	870
Phase 2 only	16.9%	47.0%	-21.0%	0
Tan Bien scheme	18.8%	75.0%	-31.0%	0
Duc Hoa scheme	16.4%	41.0%	-20.0%	0

38. The sensitivity analysis confirms the conclusion that continuing investment in phase 2 to complete the project is viable having a higher economic return than the option of stopping the project at phase 1.

39. The economic value of the water supplied for industrial use in the medium to long term future has not been fully taken account of in the economic analysis and its economic return is likely to be higher than its marginal return for use in agriculture. Further study is needed to investigate the value and associated positive and negative impact of industrial expansion. The long term persisting value of the project may be its contribution to economic development in the region through providing a reliable supply of low cost water for industrial use.

I. Financial Analysis

40. A farm model analysis has been prepared to show the impact of irrigation development on a typical farm and the change in household income expected to occur after full development of irrigation and more intensive agriculture. The same crop budgets and cropping patterns in Tan Bien and Duc Hoa schemes as used for the economic analysis were used, but with current financial prices rather than economic prices. The parameters for the farm models (size and seasonal cropping pattern) are based on the information obtained from the area and from the comprehensive household survey conducted for the previous feasibility study.

1. Farm models

41. A summary of the representative farm models used in the analysis is presented below.

Table 13: Farm Models for Tan Bien and Duc Hoa

1. Tan Bien Subproject Area		
Season	Current Situation and Future Without-project Situation	Future With-project Situation
Large size farm (6 ha)		
All Year	35% sugar cane 7% fruit	20% sugar cane 10% fruit
Winter-spring season (Dry)	10% rice 3% peanuts 25% Cassava 2% Vegetables	20% rice 10% maize 10% peanuts 15% Cassava 4% Vegetables
Summer-Autumn (Monsoon)	25% rice 25% Cassava 2% Vegetables	50% rice 15% Cassava 4% Vegetables
Autumn- Winter	10% rice 3% peanuts 25% Cassava 2% Vegetables	20% rice 15% maize 10% peanuts 15% Cassava 4% Vegetables
Small Farm (1 ha)		
All Year		1% fruit
Winter-spring season (Dry)	0% rice 10% maize 3% peanuts 50% Cassava 2% Vegetables	20% rice 20% maize 25% peanuts 20% Cassava 4% Vegetables
Summer-Autumn (Monsoon)	50% rice 3% peanuts 35% Cassava 2% Vegetables	80% rice 3% peanuts 10% Cassava 4% Vegetables
Autumn- Winter	10% rice 5% maize 3% peanuts 50% Cassava 2% Vegetables	40% rice 15% maize 15% peanuts 20% Cassava 4% Vegetables

2. Duc Hoa Subproject		
Season	Current Situation/Future Without-project Situation	Future With-project Situation
<u>Large Farm (2 ha)</u>		
All year	1% fruit	2% fruit
Winter-spring (Dry) season	0% rice 10% maize 20 peanuts 1% Vegetables	35% rice 30% maize 25% peanuts 4% Vegetables
Summer-Autumn (Monsoon)	85% rice 2% Vegetables	90% rice 3% Vegetables
Autumn- Winter	40% rice 10% maize 11% peanuts 2% Vegetables	50% rice 20% maize 20% peanuts 4% Vegetables
<u>Small Farm (0.2 ha)</u>		
All year		1% fruit
Winter-spring (Dry) season	0% rice 10% maize 60% peanuts 1% Vegetables	20% rice 20% maize 50% peanuts 3% Vegetables
Summer-Autumn (Monsoon)	80% rice 1% Vegetables	95% rice 2% Vegetables
Autumn- Winter	40% rice 10% maize 20% peanuts 2% Vegetables	50% rice 20% maize 20% peanuts 4% Vegetables

42. The models show a significant change in the cropping pattern between the present/future without situation and the future with-project situation. This reflects the likely changes in cropping pattern as farmers move out of less profitable but less risky crops such as sugar cane and cassava and switch to more profitable crops to take advantage of the higher returns that can be achieved with irrigation, such as rice, vegetables and fruit cultivation.

2. Farm income analysis

43. Net incremental farm income after full development of irrigation for the farm models is shown in the table below. All the farm models show a considerable increase in net farm income ranging from D21.83 million to D31.93 million per ha (\$1,150 to \$1,682). In terms of percentage increase in farm income the range is from 102% to 258%. The increase in farm income is higher for the Duc Hoa area than for Tan Bien, on account of the more intensive agriculture practiced in Duc Hoa and the greater impact of improved irrigation. It can be concluded that the increase in farm incomes should be sufficient incentive and motivation for the farmer beneficiaries to commit to the project and take advantage of the opportunities provided by irrigation development.

Table 14: Farm Income Analysis

Farm model	Area	Increase in net income D'000			Increase in net income \$	
	Area	Per farm	Per ha	% inc.	Per farm	Per ha
Tan Bien - large	6.0	130,982	21,830	102	6,901	1,150
Tan Bien - small	2.0	50,654	25,327	119	2,669	1,334
Duc Hoa - large	2.0	63,856	31,928	258	3,364	1,682
Duc Hoa – small	0.5	14,883	29,766	194	784	1,568

44. A major contributing factor to the relatively high returns following adoption of irrigation is because farmers do not have to bear the full cost of the investment in developing the irrigation infrastructure. The farmer only has to fund the on-farm development and make a contribution of his labor for constructing the tertiary system, in some locations. They are not required to make any contribution to the cost of the other irrigation infrastructure.

			Note	Rice			Maize			Groundnut oil			Groundnut meal						
Export/Import Substitute				Export			Import			Import			Import		(Soybean meal)				
Marker product location			1/	Thailand			US			US			US						
Quality of marker product			2/	5% broken															
				2010	2015	2020		2010	2015	2020		2010	2015	2020		2010	2015	2020	
US\$/ton	World price Jan-May 2010	3/	=	506				162				1,358				359			
	Indicator price - 2000 base	4/	=	381	381	382		138	141	138	=	1,098	1,074	877	=	290	250	240	
	Indicator price - 2010 base adjusted by MUV 2000 to 2010	5/	=	453	453	454		164	168	164	=	1,305	1,277	1,043	=	345	297	285	
	Quality differential	6/	x	0.9	0.9	0.9		x	0.9	0.9	0.9	x	1.0	1.0	1.0	x	1.3	1.3	1.3
	Equivalent value of Vietnam product	7/	=	351	351	351		124	127	124	=	1,098	1,074	877	=	377	325	312	
	Freight & insurance (to/from Vietnam port)		=	0	0	0		+	60	60	60	+	60	60	60	+	60	60	60
Value at Vietnam port				=	351	351	351	=	184	187	184	=	1,158	1,134	937	=	437	385	372
VND'000/kg	Value at Vietnam port	8/	=	6,660	6,660	6,677		=	3,500	3,551	3,500	=	22,002	21,546	17,803	=	8,303	7,315	7,068
	Port charges		-	100	100	100		+	100	100	100	+	100	100	100	+	100	100	100
	Handling/transport/trader margin - between wholesaler and port		-	200	200	200		+	200	200	200	+	200	200	200	+	200	200	200
	Value at wholesale market		=	6,360	6,960	6,977		=	3,800	3,851	3,800	=	22,302	21,846	18,103	=	8,603	7,615	7,368
	Handling/transport/trader margin - between local and wholesale market		-	200	200	200		-	200	200	200	-	200	200	200	-	200	200	200
	Processing cost		-	100	100	100		na	0	0	0	-	2,500	2,500	2,500	na	0	0	0
	Value before processing	9/	=	3,707	4,085	4,096		=	3,600	3,651	3,600	=	7,841	7,658	6,161	=	8,403	7,415	7,168
	Handling/transport/trader margin - from farmgate to local market		-	45	45	45		-	45	45	45	-	45	45	45	-			
Value at farmgate				=	3,662	4,040	4,051	=	3,555	3,606	3,555	=	8,986	8,444	7,292	=			
Crop form at farmgate						paddy				dry grain				Un-shelled dried nuts					
			Note	Urea			TSP			KCI			DAP						
Normally exported or imported				Imported (bulk)			Imported (bagged)			Imported (bagged)			Imported						
Marker product location			1/	Europe			USA			Canada									
Nutrient content of marker product			2/	N%	46		P%	36		K%	60								
				2010	2015	2020		2010	2015	2020		2010	2015	2020		2010	2015	2020	
US\$/ton	World price Jan-May 2008	3/	=	265				335				326				464			
	Indicator price - 2000 base	4/	=	186	162	194		=	224	251	269	=	331	207	174	=	249	292	316
	Indicator price - 2010 base adjusted by MUV 2000 to 2010	5/	=	221	193	231		=	266	298	320	=	394	246	207	=	296	347	376
	Quality differential	6/	x	1.0	1.0	1.0		x	1.0	1.0	1.0	x	1.0	1.0	1.0	x	1.0	1.0	1.0
	Equivalent value of Vietnam product	7/	=	186	162	194		=	224	251	269	=	331	207	174	=	249	292	316
	Freight & insurance (to/from Vietnam port)		+	60	60	60		+	60	60	60	+	60	60	60	+	60	60	60
Value at Vietnam port				=	246	222	254	=	284	311	329	=	391	267	234	=	309	352	376
VND'000/kg	Value at Vietnam port	8/	=	4,674	4,218	4,826		=	5,396	5,909	6,251	=	7,429	5,073	4,446	=	5,871	6,688	7,144
	Port charges		+	100	100	100		+	100	100	100	+	100	100	100	+	100	100	100
	Handling/transport/trader margin - between port and salepoint		+	300	300	300		+	300	300	300	+	300	300	300	+	300	300	300
	Value at sale point		=	4,974	4,518	5,126		=	5,796	6,309	6,651	=	7,829	5,473	4,846	=	6,271	7,088	7,544
	Handling/transport/trader margin - from sale point to farmgate		+	125	125	125		+	125	125	125	+	125	125	125	+	125	125	125
	Value at farmgate (fertiliser)		=	5,099	4,643	5,251		=	5,921	6,434	6,776	=	7,954	5,598	4,971	=	6,396	6,396	6,396
	Value at farmgate (nutrient)		=	11,085	10,093	11,415		=	16,447	17,872	18,822	=	13,257	9,330	8,285				
	Form at farmgate						bagged				bagged				bagged				bagged
1/ Source of marker product or of product imported into Vietnam				7/ Marker price x quality differential factor															
2/ Quality standard of marker product				8/ US\$/ton value converted to VND/kg at 1 US\$ = VND'000				19											
3/ World Bank. Pink sheets, June 2010				9/ Assumes 63% conversion from paddy to milled rice															
4/ World Bank Projections, June 2010				10/ Conversion from shelled groundnuts to groundnut oil				0.4											
5/ Price in constant 2009 US\$. World Bank Commodity Price Projections, June 2010				groundnuts to groundnut meal				0.6											
having applied MUV factor April 2010 of :			1.189	(Groundnut shelling 70%)															

Tan Bien crop budgets

Net crop returns, VND/ha @ constant 2010 financial and economic prices. Tan Bien																										Economic returns per ha.VND'000																							
Crop		Yields and physical inputs per ha												Financial returns per ha. VND'000																								Unit Values											
		rice		rice		vegetables		peanuts		maize				rice		rice		vegetables		peanuts		maize				rice		rice		vegetables		peanuts		maize				Financial	Economic										
Details		WP/WOP	Season	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp														
		Irrigated/rainfed		wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp														
			Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit	Unit													
Yields/Returns																																																	
Main Crop	rice	tonne	4.80																																	5500.00	4045.23												
	rice	tonne		5.50																																5500.00	4045.23												
	rice	tonne			4.20																															5500.00	4045.23												
	rice	tonne				5.50																														5500.00	4045.23												
	vegetables	tonne					15.50																													3500.00	3500.00												
	vegetables	tonne						17.00																												3500.00	3500.00												
	peanuts	tonne							2.00																											15500.00	7867.79												
	peanuts	tonne								2.50																										15500.00	7867.79												
Gross returns	maize	tonne																																			4200.00	3580.45											
	maize	tonne								5.00																										4200.00	3580.45												
	maize	tonne									6.0																									4200.00	3580.45												
Seeds & planting material	rice	kg	180																																	6.60	4.85												
	rice	kg		180																																6.60	4.85												
	rice	kg			180																															6.60	4.85												
	rice	kg				180																														6.60	4.85												
	vegetables	kg					5																													43.00	43.00												
	vegetables	kg						5																												43.00	43.00												
	peanuts	kg							220																											22.00	22.00												
	peanuts	kg								220																										22.00	22.00												
	maize	kg									20																										40.00	40.00											
	maize	kg										20																									40.00	40.00											
	maize	kg											20																								40.00	40.00											
	Agro chemicals & manure	Urea	kg	150	175	150	175	200	200	200	200	0	0	900	1,050	900	1,050	1,200	1,200	1,200	1,200	0	0	742	866	742	866	989	989	989	989	0	0	640	1,279	9	60	4,95	6,00										
DAP		kg	0	0	0	0	0	400	400	0	0	100	200	0	0	0	3,840	3,840	0	0	0	960	1,920	0	0	0	0	2,558	2,558	0	0	640	1,279	9	60	4,95	6,00												
NPK		kg	0	0	0	0	0	0	0	200	250	200	600	0	0	0	0	0	0	1,600	2,000	1,600	4,800	0	0	0	0	0	0	1,087	1,359	1,087	3,262	8.00	5.44	8.00	5.44												
superphosphate		kg	300	300	300	300	300	300	300	300	0	0	0	0	0	1,200	1,200	1,200	1,200	1,200	1,200	0	0	1,982	1,982	1,982	1,982	1,982	1,982	1,982	1,982	0	0	0	0	4.00	6.61												
KCl		kg	100	100	100	100	200	200	0	0	0	0	0	0	0	600	600	600	600	1,200	1,200	0	0	0	0	0	0	0	0	0	0	0	0	0	6.00	5.28													
Lime		kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												
Manure		tonne	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												
Rice husk ash		tonne	0	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150.00	150.00												
Agro-chemicals		lumpsum	1.8	1.8	1.8	1.8	6.3	6.3	3.5	3.5	0.8	1	1,800	1,800	1,800	1,800	6,346	6,346	3,500	3,500	750	1,200	1,800	1,800	1,800	1,800	6,346	6,346	3,500	3,500	750	1,200	1,800	1,800	1,000.00	1,000.00													
Equipment, materials etc		Land preparation	ha	1	1	1	1	1	1	1	2	2	1	500	500	500	500	500	500	1,000	1,000	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500										
		Rotavating	ha	1	1	1	1	1	1	1	1	1	1	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500										
		Discing	ha	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0											
	Ridging	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												
	Harvesting	ha	4.8	5.5	4.2	5.5	0.0	0.0	0.0	0.0	0.0	0.0	1,440	1,650	1,260	1,650	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300.00	300.00												
	Transport	ton	4.8	5.5	4.2	5.5	15.5	17.0	2.0	2.5	5.0	6.0	173	198	151	198	558	612	72	90	180	216	173	198	151	198	558	612	72	90	180	216	36.00	36.00	36.00	36.00													
	Bags etc	lumpsum	4.8	5.5	4.2	5.5	15.5	17.0	2.0	2.5	5.0	6.0	158	182	139	182	512	561	66	83	165	198	158	182	139	182	512	561	66	83	165	198	33.00	33.00	33.00	33.00													
	Other	lumpsum	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56												
	Labour	Hired/family	workday	31	26	31	26	157	157	61	57	62	58	2,325	1,950	2,325	1,950	11,775	11,775	4,575	4,275	4,650	4,350	1,860	1,560	1,860	1,560	9,420	3,660	9,420	3,660	3,420	3,720	3,480	75.00	60.00													
		Pumping	workday	0.5	0.0	1.0	0.0	1.2	0.0	0.8	0.0	0.8	0.0	1,200	0	2,400	0	2,880	0	1,920	0	1,920	0	1,200	0	2,400	0	2,880	0	1,920	0	1,920	0	2,400	0	2,400.00	2,400.00												
		Water use	M3	-	2,225	8,734	8,734	8,000	8,000	4,400	4,400	4,681	4,681	542	544	531	544	1,395	1,400	983	990	533	752	531	535	520	535	1,235	1,240	901	1,102	445	600	5.0%	5.0%														
	Total costs																																																
Net returns -																																																	
Net returns - excl labour																																																	
Net returns to water (D/m3)					</																																												

Duc Hoa crop budgets

Net crop returns, VND/ha @ constant 2010 financial and economic prices. Duc Hoa																																									
		Yields and physical inputs per ha														Financial returns per ha, VND'000												Economic returns per ha, VND'000												Unit Values	
Crop	WP/WOP Season Irrigated/rainfed	rice		rice		maize		maize		peanuts		peanuts		rice		rice		maize		maize		peanuts		peanuts		rice		rice		maize		maize		peanuts		peanuts		Financial	Economic		
		irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed						
Details		Unit	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	Unit m	VND/ha	VND/ha			
Yields/Returns																																									
Main Crop	rice	tonne	3.75											20.625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.500	4.045				
	rice	tonne		5.00										0	27.500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.500	4.045				
	rice	tonne			4.00									0	22.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.500	4.045					
	rice	tonne				5.50								0	0	30.250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.500	4.045					
	maize	tonne					5.00							0	0	0	21.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.200	3.580					
	maize	tonne						6.00						0	0	0	0	25.200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.200	3.580					
	maize	tonne							4.00					0	0	0	0	0	16.800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.200	3.580					
	maize	tonne								5.00				0	0	0	0	0	0	21.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.200	3.580					
	peanuts	tonne									2.00			0	0	0	0	0	0	0	0	31.000	0	0	0	0	0	0	0	0	0	0	0	0	0	15.500	7.868				
	peanuts	tonne										2.50		0	0	0	0	0	0	0	0	0	38.750	0	0	0	0	0	0	0	0	0	0	0	0	15.500	7.868				
	peanuts	tonne											1.80	0	0	0	0	0	0	0	0	0	0	27.900	0	0	0	0	0	0	0	0	0	0	0	17.309	7.868				
peanuts	tonne												2.20	0	0	0	0	0	0	0	0	0	0	34.100	0	0	0	0	0	0	0	0	0	0	15.500	7.868					
Gross returns														20.625	27.500	22.000	30.250	21.000	25.200	16.800	21.000	31.000	38.750	27.900	34.100	15.170	20.226	16.181	22.249	17.902	21.483	14.322	17.902	15.736	19.669	14.162	17.309				
Inputs/Costs														1.056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.60	4.85					
Seeds & planting material	rice	kg	160											0	1.056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.60	4.85					
	rice	kg		160										0	0	1.056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.60	4.85					
	rice	kg			160									0	0	0	1.056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.60	4.85					
	maize	kg				20								0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40.00	40.00						
	maize	kg					20							0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40.00	40.00						
	maize	kg						20						0	0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0	0	40.00	40.00						
	maize	kg							20					0	0	0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0	40.00	40.00						
	peanuts	kg								220				0	0	0	0	0	0	0	0	4.840	0	0	0	0	0	0	0	0	0	0	0	22.00	22.00						
	peanuts	kg									220			0	0	0	0	0	0	0	0	0	4.840	0	0	0	0	0	0	0	0	0	0	0	22.00	22.00					
	peanuts	kg										220		0	0	0	0	0	0	0	0	0	0	4.840	0	0	0	0	0	0	0	0	0	0	22.00	22.00					
Agro chemicals & manure	Urea	kg	100	125	100	125	0	0	0	0	200	200	200	200	600	750	600	750	0	0	0	1.200	1.200	1.200	1.200	495	618	495	618	0	0	0	989	989	989	989	6.00	4.95			
	DAP	kg	0	0	0	0	200	200	200	200	0	0	0	0	0	0	1.920	1.920	1.920	1.920	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9.60	6.40					
	NPK	kg	400	400	400	400	500	600	500	600	200	250	200	250	3.200	3.200	3.200	3.200	4.800	4.800	4.800	1.600	2.000	1.600	2.000	2.175	2.175	2.175	2.175	2.718	3.262	1.087	1.359	1.087	1.359	8.00	5.44				
	superphosphate	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.00	6.61						
	KCl	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.00	5.28						
	Lime	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.54	0.54						
	Manure	tonne	0	0	0	0	0	0	0	0	5	5	5	5	0	0	0	0	0	0	0	750	750	750	750	0	0	0	0	0	0	0	750	750	150.00	150.00					
	Rice husk ash	tonne	0	0	0	0	0	0	0	0	10	10	10	10	0	0	0	0	0	0	0	1.500	1.500	1.500	1.500	0	0	0	0	0	0	0	1.500	1.500	150.00	150.00					
	Agro-chemicals	tonne	2.5	2.5	2.5	2.5	1.0	1.0	1.0	1.0	3.5	3.5	3.5	3.5	2.500	2.500	2.500	2.500	981	981	981	3.500	3.500	3.500	3.500	2.500	2.500	2.500	2.500	981	981	3.500	3.500	3.500	3.500	1.000.00	1.000.00				
	Land preparation	ha	2	2	2	2	1	1	1	1	2	2	2	2	1.000	1.000	1.000	1.000	500	500	500	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	500	500	1.000	1.000	500.00	500.00						
Equipment, materials etc	Rotavating	ha	1	1	1	1	1	1	1	1	1	1	1	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500.00	500.00				
	Discing	ha	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	500	500	500	500	0	0	0	0	0	0	0	0	0	0	0	0	500.00	500.00					
	Ridging	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600.00	600.00					
	Harvesting	ha	3.75	5.00	4.00	5.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.125	1.500	1.200	1.650	0	0	0	0	0	0	0	0	1.125	1.500	1.200	1.650	0	0	0	0	300.00	300.00						
	Transport	ton	3.8	5.0	4.0	5.5	5.00	6.0	4.0	5.0	2.0	2.5	1.8	2.2	135	180	144	198	180	216	144	180	72	90	65	79	135	180	144	198	180	216	144	180	72	90	36.00	36.00			
	Bags etc	tonne	3.8	5.0	4.0	5.5	5.0	6.0	4.0	5.0	2.0	2.5	1.8	2.2	124	165	132	182	165	198	132	165	66	83	59	73	124	165	132	182	165	198	132	165	66	83	33.00	33.00			
	Other	tonne	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	55.50	55.50						
	Hired/family	workday	31	26	31	26	62	58	62	58	61	57	61	57	2,325	1,940	2,325	1,950	4,650	4,350	4,650	4,350	4,575	4,275	4,275	4,275	1,860	1,560	1,860	1,560	3,720	3,480	3,660	3,420	3,660	3,420	75.00	60.00			
	Pumping	season	1.0	0.0	1.0	0.0	1.1	0.0	0.4	0.0	0.8	0.0	0.6	0.0	2.400	0	2.400	0	2.592	0	960	0	1.920	0	1.440	0	2.400	0	2.400	0	2.592	0	960	0	1.920	0	1.440	2.400.00	2.400.00		
	Water use	M3	8.734	8.734	-	2.225	4.681	4.681	100	100	4.400	4.400	-	1.000	631	643	636	652	713	741	709	738	983	990	982	989	532	552	542	561	570	589	566	585	901	904	900	903	5.00	5	

Long term and perennial crops

Net crop returns, VND/ha @ constant 2010 financial and economic prices. Tan Bien and Duc Hoa.																																			
Yields and physical inputs per ha															Financial returns per ha,VND'000.										Economic returns per ha, VND'000					Unit Values					
Crop	WP/WOP Season Irrigated/rainfed	sugarcane yr 1		sugarcane yr 2-4		sugarcane - ave		cassava		Fruit		sugarcane yr 1		sugarcane yr 2-4		sugarcane - ave		cassava		Fruit		sugarcane yr 1		sugarcane yr 2-4		sugarcane - ave		cassava		Fruit		Financial	Economic		
		wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp	wp				
Details		all	irrigated	all	irrigated	all	irrigated	all	irrigated	s-a/a-w	s-a/a-w	s-a/a-w	s-a/a-w	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	rainfed	irrigated	VND/Unit	VND/Unit		
Yields/Returns																																			
Main Crop	sugarcane yr 1	tonne	60.00										36,000	0	0	0	0	0	0	0	0	0	36,000	0	0	0	0	0	0	0	0	600.00	600.00		
	sugarcane yr 1	tonne		75.00									0	45,000	0	0	0	0	0	0	0	0	0	45,000	0	0	0	0	0	0	0	600.00	600.00		
	sugarcane yr 2-4	tonne			60.00								0	0	36,000	0	0	0	0	0	0	0	0	0	36,000	0	0	0	0	0	0	600.00	600.00		
	sugarcane yr 2-4	tonne				75.00							0	0	0	45,000	0	0	0	0	0	0	0	0	0	45,000	0	0	0	0	0	600.00	600.00		
	sugarcane - ave	tonne					60.00						0	0	0	0	36,000	0	0	0	0	0	0	0	0	36,000	0	0	0	0	0	600.00	600.00		
	sugarcane - ave	tonne						75.00					0	0	0	0	0	45,000	0	0	0	0	0	0	0	0	0	45,000	0	0	0	600.00	600.00		
	cassava	tonne							35.00				0	0	0	0	0	0	26,250	0	0	0	0	0	0	0	0	0	26,250	0	0	750.00	750.00		
	cassava	tonne								43.75			0	0	0	0	0	0	0	0	32.813	0	0	0	0	0	0	0	0	32,813	0	0	750.00	750.00	
fruit	tonne									15.00		0	0	0	0	0	0	0	0	0	90,000	0	0	0	0	0	0	0	0	90,000	0	0	6000.00	6000.00	
fruit	tonne									20.00		0	0	0	0	0	0	0	0	0	0	120,000	0	0	0	0	0	0	0	0	120,000	0	0	6000.00	6000.00
Gross returns																																			
Inputs/Costs																																			
Seed	sugarcane yr 1	kg	40,000										9,600	0	0	0	0	0	0	0	0	0	9,600	0	0	0	0	0	0	0	0	0.24	0.24		
	sugarcane yr 1	kg		40,000									0	9,600	0	0	0	0	0	0	0	0	0	9,600	0	0	0	0	0	0	0	0.24	0.24		
	sugarcane yr 2-4	kg			0								0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.24	0.24		
	sugarcane yr 2-4	kg				0							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.24	0.24		
	sugarcane - ave	kg					10,000						0	0	0	0	2,400	0	0	0	0	0	0	0	0	0	0	2,400	0	0	0	0.24	0.24		
	sugarcane - ave	kg						10,000					0	0	0	0	0	2,400	0	0	0	0	0	0	0	0	0	0	2,400	0	0	0	0.24	0.24	
Agro chemicals & manure	cassava	cutting							20,000				0	0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	800	0	0	0.04	0.04	
	cassava	cutting								20,000			0	0	0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	800	0	0	0.04	0.04
	Urea	kg	400	400	400	400	400	400	0	0	300	400	2,400	2,400	2,400	2,400	2,400	2,400	0	0	1,800	2,400	1,979	1,979	1,979	1,979	1,979	1,979	1,979	1,979	1,979	6.00	4.95		
	DAP	kg	0	0	0	0	0	0	0	0	75	100	0	0	0	0	0	0	0	720	960	0	0	0	0	0	0	0	0	480	640	9.60	6.40		
	NPK	kg	0	0	0	0	0	0	0	400	400	325	300	0	0	0	0	0	3,200	3,200	2,600	2,400	0	0	0	0	0	0	2,175	2,175	1,767	1,631	8.00	5.44	
	superphosphate	kg	400	400	400	400	400	400	0	0	150	200	1,600	1,600	1,600	1,600	1,600	1,600	0	0	600	800	2,642	2,642	2,642	2,642	2,642	2,642	0	991	1,321	4.00	6.61		
Equipment, materials etc	KCl	kg	300	300	300	300	300	300	0	0	35	50	1,800	1,800	1,800	1,800	1,800	1,800	0	0	210	300	1,585	1,585	1,585	1,585	1,585	1,585	0	185	264	6.00	5.28		
	Lime	tonne	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0.54	0.54		
	Manure	tonne	0	0	0	0	0	0	5	5	3	3	0	0	0	0	0	0	750	750	450	450	0	0	0	0	0	0	750	750	450	450	150.00	150.00	
	Rice husk ash	tonne	15	15	15	15	15	15	8	8	8	8	2,250	2,250	2,250	2,250	2,250	2,250	1,200	1,200	1,200	1,200	2,250	2,250	2,250	2,250	2,250	2,250	1,200	1,200	1,200	1,200	150.00	150.00	
	Agro-chemicals	lumpsum	0.8	0.8	0.8	0.8	0.8	0.8	0.0	0.0	1.0	2.0	769	769	769	769	769	769	0	0	1,000	2,000	769	769	769	769	769	769	0	1,000	2,000	1,000.00	1,000.00		
	Land preparation	ha	2	2	2	2	2	2	1	1	2	2	0	0	0	0	250	250	1,000	1,000	0	0	1,000	1,000	0	0	250	250	1,000	1,000	0	0	500.00	500.00	
Labour	Rotavating	ha	2	2	2	2	2	2	2	0	0	0	0	1,000	1,000	1,000	1,000	1,000	0	0	0	0	1,000	1,000	1,000	1,000	1,000	1,000	0	0	0	0	500.00	500.00	
	Discing	ha	1	1	0	0	0	0	0	0	0	0	500	500	0	0	125	125	0	0	0	0	500	500	0	0	125	125	0	0	0	0	500.00	500.00	
	Ridging	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	600	600	0	0	0	0	0	0	0	0	600	600	0	0	600.00	600.00
	Harvesting	ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300.00	300.00		
	Transport	ton	60.0	75.0	60.0	75.0	60.0	75.0	35.0	43.8	15.0	20.0	2,160	2,700	2,160	2,700	2,160	2,700	1,260	1,575	540	720	2,160	2,700	2,160	2,700	2,160	2,700	1,260	1,575	540	720	36.00	36.00	
	Bags etc	lumpsum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.0	0	0	0	0	0	0	0	0	0	25	33	0	0	0	0	0	0	25	33	33.00	33.00		
Other	Other	lumpsum	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	55.50	55.50		
	Hired/family	workday	136	164	119	147	123	151	65	77	192	275	10,200	12,263	8,925	10,988	9,244	11,306	4,875	5,738	14,400	20,625	8,160	9,810	FALSE	8,790	7,395	9,045	3,900	4,590	11,520	16,500	75.00	60.00	
Total costs	Pumping	season	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,400.00	2,400.00		
	Water use	M3	-	9,000	-	9,000	-	9,000	-	4,000	8,000	8,000	35,002	37,735	22,008	24,741	25,257	27,989	14,428	15,664	24,781	33,541	33,286	35,586	13,063	22,860	23,742	26,041	12,327	13,382	20,682	28,133			
Net returns -																																			
Net returns - excl labour																																			
Net returns to water (D/m3)																																			
Source: Consultant's estimates																																			

Attachment 3: Economic Analysis Cash Flows

Phase 1 & Phase 2 combined economic analysis

Economic Costs (D Million) constant 2010 prices																					
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2036
Investment Costs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20...	30
A. Part A: Support for Institutional & Integrated Development																					
1. Project and Sustainable Management																					
Project Management Services	1,906.4	3,379.2	3,166.0	3,731.6	14,011.2	2,615.4	2,615.4	1,307.7	1,307.7												
Consultants	45,666.6	18,109.0	22,645.3	35,945.0	37,674.4	16,357.9	15,355.8	3,048.2	3,549.3												
Support for On-farm and Social Development	-	-	-	12,362.6	8,954.1	26,695.1	6,037.1	3,965.9	2,435.3												
Resettlement	10,111.4	43,129.5	19,255.9	732.3	21,548.5	4,013.9	3,952.5	3,952.5	-												
Environmental Management	-	-	1,274.3	5,406.3	6,884.2	9,324.5	4,554.4	4,400.6	576.7												
Subtotal Part A:	57,684.5	64,617.7	46,341.6	58,177.8	89,072.3	58,996.8	32,515.2	16,674.9	7,869.0	-											
B. Part B: Water Resources Infrastructure																					
1. Phuoc Hoa Basin Transfer																					
Barrage	-	149,468.9	88,482.0	233,675.9	305,621.4	-	-	-	-												
Transfer Canal	-	129,684.2	187,321.7	36,023.4	650,120.2	-	-	-	-												
Subtotal Phuoc Hoa Basin Transfer	-	279,153.1	275,803.6	269,699.3	955,741.5	-	-	-	-	-											
2. Tan Bien Irrigation System																					
Main Canals	-	11,484.6	42,110.1	22,969.2	111,683.7	-	-	-	-												
Primary/Secondary/Tertiary Canals	-	-	-	-	62,596.4	166,280.5	55,544.2	545.1	-												
On-farm & Lower Canals	-	-	-	-	-	-	-	9,271.5	9,271.5												
Subtotal Tan Bien Irrigation System	-	11,484.6	42,110.1	22,969.2	174,280.1	166,280.5	55,544.2	9,816.5	9,271.5	-											
3. Duc Hoa Irrigation System																					
Main Canals	-	-	-	-	93,450.4	140,175.6	233,626.0	-	-												
Primary/Secondary/Tertiary Canals	-	-	-	-	140,429.9	351,074.8	210,644.9	-	-												
On-farm & Lower Canals	-	-	-	-	-	-	-	15,824.2	15,824.2												
Subtotal Duc Hoa Irrigation System	-	-	-	-	233,880.3	491,250.4	444,270.9	15,824.2	15,824.2	-											
Subtotal Part B: Water Resources Infrastructure	-	290,637.7	317,913.8	292,668.5	1,363,991.9	657,530.9	499,815.1	25,640.8	25,095.7	-											
Total PROJECT COSTS	57,684.5	355,255.4	364,255.4	350,846.3	1,452,974.2	716,527.8	532,330.2	42,315.7	32,964.7	-											
Recurrent Costs & Maintenance Costs (1.5%/yr)																					
1. Phuoc Hoa Basin Transfer																					
Headworks & barrage	-	-	-	-	-	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659
Transfer canal	-	-	-	-	-	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047
2. Tan Bien Irrigation System																					
Main canal	-	-	-	-	-	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824
PST	-	-	-	-	-	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274	4,274
On-farm	-	-	-	-	-	139	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278
Tan Bien pumping	-	-	-	-	-	128	319	479	511	575	607	639	639	639	639	639	639	639	639	639	639
3. Duc Hoa Irrigation System																					
Main canal	-	-	-	-	-	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009	7,009
PST	-	-	-	-	-	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532	10,532
On-farm	-	-	-	-	-	237	475	475	475	475	475	475	475	475	475	475	475	475	475	475	475
Sub-total Recurrent & Maintenance	-	-	-	-	-	29,530	29,530	47,198	51,665	52,201	52,609	52,673	52,705	52,737	52,737	52,737	52,737	52,737	52,737	52,737	52,737
Total Costs	57,684	355,255	364,255	350,846	1,452,974	746,057	561,860	89,514	84,629	52,201	52,609	52,673	52,705	52,737	52,737	52,737	52,737	52,737	52,737	52,737	52,737
Incremental Benefits																					
Agricultural benefits																					
Duc Hoa	0	0	0	0	0	30,354	60,708	91,062	151,771	227,656	258,010	273,187	288,364	303,541	303,541	303,541	303,541	303,541	303,541	303,541	303,541
Irrigation supply to HCMC area	0	0	0	0	0	593	1,186	1,779	2,965	4,447	5,040	5,337	5,633	5,930	5,930	5,930	5,930	5,930	5,930	5,930	5,930
Irrigation supply to Tay Ninh area	0	0	0	0	0	1,811	3,622	5,434	9,056	13,584	15,396	16,301	17,207	18,112	18,112	18,112	18,112	18,112	18,112	18,112	18,112
Tan Bien (gravity)	0	0	0	0	0	7,130	14,261	21,391	35,652	53,478	60,608	64,173	67,738	71,303	71,303	71,303	71,303	71,303	71,303	71,303	71,303
Tan Bien (pump)	0	0	0	0	0	1,738	3,477	5,215	8,692	13,038	14,777	15,646	16,515	17,384	17,384	17,384	17,384	17,384	17,384	17,384	17,384
Sub-total ag benefits	0	0	0	0	0	41,627	83,254	124,881	208,136	312,204	353,831	374,644	395,458	416,271	416,271	416,271	416,271	416,271	416,271	416,271	416,271
DMI Water transfer benefits																					
Duc Hoa (4m3/s)	0	0	0	0	0	23,852	33,113	42,574	52,034	61,495	66,226	70,956	75,686	80,417	85,147	89,878	94,608	94,608	94,608	94,608	94,608
Tan Bien (3.5m3/s)	0	0	0	0	0	8,278	12,417	16,556	20,696	24,835	28,974	33,113	37,252	41,391	45,530	49,669	53,808	53,808	53,808	53,808	53,808
Binh Phuoc	5,913	8,870	11,826	17,739	23,652	29,565	35,478	41,391	53,217	59,130	70,956	82,782	94,608	106,434	118,260	129,086	140,912	152,738	164,564	176,390	188,216
Binh Duong	17,739	26,609	35,478	53,217	70,956	88,695	106,434	124,173	159,651	177,390	212,868	248,346	283,824	319,302	354,780	390,258	425,736	461,214	496,692	532,170	567,648
HCMC	12,417	18,626	24,835	37,252	49,669	62,087	74,504	86,921	111,756	124,173	149,008	173,842	198,677	223,511	248,346	273,180	298,014	322,848	347,682	372,516	397,350
Sub-total DMI benefits	0	36,069	54,104	104,069	153,738	203,407	253,076	302,746	347,684	428,693	473,631	554,639	639,787	724,934	810,081	895,228	980,375	1,065,522	1,150,669	1,235,816	1,320,963
Total Benefits	-	-	-	-	-	36,069	54,104	145,696	236,992	328,289	461,212	614,949	701,515	803,337	869,089	970,911	1,056,058	1,141,205	1,226,352	1,306,769	1,315,047
NET CASH FLOW	-	57,684	355,255	364,255	350,846	1,452,974	709,988	507,756	56,182	152,363	276,088	408,603	562,276	648,810	750,600	816,352	918,174	1,003,321	1,088,468	1,173,615	1,262,310
EIRR	12.3%																				

Phase 1 only economic analysis

Economic Costs (D Million) constant 2010 prices																					
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2036
Investment Costs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20...	30
A. Part A: Support for Institutional & Integrated Development																					
Project Management Services	1,906.4	3,379.2	3,166.0	3,731.6	11,732.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Consultants	45,666.6	18,109.0	22,645.3	35,945.0	23,185.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Support for On-farm and Social Development	-	-	-	12,362.6	6,323.5	3,789.9	619.0	184.4	-	-	-	-	-	-	-	-	-	-	-	-	-
Resettlement	10,111.4	43,129.5	19,255.9	732.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Environmental Management	-	-	1,274.3	5,406.3	6,085.7	5,120.1	678.6	343.7	343.7	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal Part A:	57,684.5	64,617.7	46,341.6	58,177.8	47,326.9	8,910.0	1,297.6	528.2	343.7	-	-	-	-	-	-	-	-	-	-	-	-
B. Part B: Water Resources Infrastructure																					
1. Phuoc Hoa Basin Transfer																					
Barrage	-	149,468.9	88,482.0	233,675.9	305,821.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transfer Canal	-	129,884.2	187,321.7	36,023.4	650,120.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal Phuoc Hoa Basin Transfer	-	279,153.1	275,803.6	269,699.3	955,741.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Tan Bien Irrigation System																					
Main Canals	-	11,484.6	42,110.1	22,969.2	111,683.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal Part B: Water Resources Infrastructure	-	290,637.7	317,913.8	292,668.5	1,067,425.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total PROJECT COSTS	57,684.5	355,255.4	364,255.4	350,846.3	1,114,752.1	8,910.0	1,297.6	528.2	343.7	-	-	-	-	-	-	-	-	-	-	-	-
Recurrent Costs & Maintenance Costs (1.5%/yr)																					
1. Phuoc Hoa Basin Transfer																					
Headworks & barrage					11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659	11,659
Transfer canal					15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047	15,047
2. Tan Bien Irrigation System																					
Main canal						2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824
Sub-total Recurrent & Maintenance	-	-	-	-	-	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530
Total Costs	57,684	355,255	364,255	350,846	1,114,752	38,440	30,827	30,058	29,873	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530	29,530
Incremental Benefits																					
Agricultural benefits																					
Duc Hoa																					
Tan Bien (gravity)																					
Tan Bien (pump)																					
Sub-total ag benefits					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DMI Water transfer benefits																					
Duc Hoa (4m3/s)					0	0	8,278	12,417	16,556	20,696	24,835	28,974	33,113	37,252	41,391	49,669	57,947	66,226	74,504	82,782	
Tan Bien (3.5m3/s)						5,913	8,870	11,826	17,739	23,652	29,565	35,478	41,391	53,217	59,130	70,956	82,782	94,608	106,434	118,260	
Binh Phuoc						17,739	26,609	35,478	53,217	70,956	88,695	106,434	124,173	159,651	177,390	212,868	248,346	283,824	319,302	354,780	
Binh Duong						12,417	18,626	24,835	37,252	49,669	62,087	74,504	86,921	111,756	124,173	149,008	173,842	198,677	223,511	248,346	
HCMC					0	36,069	54,104	80,417	120,625	160,834	201,042	241,250	281,459	357,737	397,945	474,223	554,639	635,056	715,473	795,890	
Sub-total DMI benefits					0	36,069	54,104	80,417	120,625	160,834	201,042	241,250	281,459	357,737	397,945	474,223	554,639	635,056	715,473	795,890	
Total Benefits	-	-	-	-	-	36,069	54,104	80,417	120,625	160,834	201,042	241,250	281,459	357,737	397,945	474,223	554,639	635,056	715,473	795,890	
NET CASH FLOW	- 57,684	- 355,255	- 364,255	- 350,846	- 1,114,752	- 2,370	23,277	50,359	90,752	131,304	171,512	211,721	251,929	328,207	368,415	444,693	525,110	605,527	685,943	766,360	
EIRR	10.8%																				

Tan Bien Subproject economic analysis

	Tan Bien Sub-project - Economic Cost-Benefit Analysis Constant 2010 economic prices. VND million										(Gravity and pump area)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
--	---	--	--	--	--	--	--	--	--	--	-------------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

